

ROYAL ASTRONOMICAL SOCIETY.

VOL. XI.

January 10, 1851.

No. 3.

Rev. R. SHEEPSHANKS, Vice-President, in the Chair.

E. F. T. Fergusson, Esq., Indian Navy;

Isaac Brown, Esq., Ackworth, near Wakefield; and

William Simms, junior, Esq., 138 Fleet Street,

were balloted for and duly elected Fellows of the Society.

Astronomische Nachrichten.

The Fellows of the Royal Astronomical Society will be gratified to learn that the publication of the *Astronomische Nachrichten* is continued under the care of Professor Hansen and Dr. Petersen. The loss of the lamented Professor Schumacher could not be more satisfactorily supplied than by the new editors; and we may, perhaps, be allowed to urge it as a duty on all lovers of the science, liberally to support the undertaking by communications and otherwise.

Newly discovered Inner Dark Ring of Saturn.

The editor of the *Monthly Notices* calls attention to the following important errors at pp. 23 and 24 of the number for last December.

At page 23, 3 lines from the bottom, should be inserted, ["Here follows a diagram illustrating the appearances."] This passage was omitted by the compositor, as the signs [] are the usual mode of directing the printer to leave out the matter inclosed; and as the diagram was not appended, the editor overlooked the omission.

The unfortunate absence of this sketch caused the editor to misunderstand the true import of that part of Mr. Dawes' journal which refers to the appearance of *Saturn* on Nov. 29. With the sketch, which is nearly identical with the right-hand half of the wood-engraving, it would have been self-evident from the journal that Mr. Dawes saw on Nov. 29, and even on Nov. 25, pretty much the same phenomena as were visible to him and to Mr. Lassell at later dates. The note p. 18 is incorrect in not calling attention to this fact.

Again, at p. 24, line 9, after Mr. Lassell's description that the space between the inner ring and the ball appeared as if a crape veil had been thrown over half of it, the next sentence in the *proof* and *manuscript* was as follows:—"From *c* to *d* a little shaded off, and from *d* to the commencement of *b* was of uniform grey colour, whilst *b* was as black as any part of the sky, or as the shadow of the ball on the following side of the ring." As there were no letters to the woodcut, the editor added the following foot-note to the *proof*:

"*c* is the dark inner edge of the bright ring, which shades off a little to *d*; the dark ring is then of a uniform grey colour: *b* is the sky seen between Bond's ring and the planet."

Unluckily the printer mistook the direction, and replaced Mr. Lassell's text by the editor's note. In the *revise* the latter passage was directed to be made a note, but the loss of Mr. Lassell's original passage was not perceived. Finally, in the last and very hurried revision, an hour before going to press, when the original manuscript was not at hand, it was perceived that the note had nothing to refer to, and the text was formed as it stands at present, omitting, what ought to have been stated, that the words used were the editor's explanation by means of the woodcut, of what he understood by Mr. Lassell's description. The lost passage and note should be inserted instead of the words, "There is a dark inner edge . . . between Bond's ring and the planet."

Extract from a Letter received from Mr. Dawes.

"I regret to find that, in some quarters, the extent of my claim to the *independent discovery* of a new appendage to *Saturn's* ring, founded on my observations of Nov. 29, 1850, does not appear to be correctly appreciated;* and it has been urged upon me to state in a connected form what I considered to have been established by the observations of that evening.

"It must be acknowledged that rough original entries, made in the utmost haste under the fear of losing the precious starlight, and of disordering the optic nerve by long or frequent exposure to the light of the lamp, do not always fully express what the observer intended to convey; and sometimes it is not easy to do so, even by the utmost care in the description, without an illustrative picture. I was aware that my original records on the evening in question required such assistance, especially as the phenomena were at first made out and recorded *separately*. I therefore drew a large coarse diagram in my journal in immediate connexion with the entries;

* In giving an account of what he saw at Watlingbury in company with Mr. Dawes, Mr. Lassell confined himself to describing his own impressions, well knowing that Mr. Dawes would himself communicate his series of observations, which were, therefore, not alluded to. The mistake of the Editor, which has probably misled other persons, arose from the simple circumstance that Mr. Lassell sent a drawing of what he saw on Dec. 3d, and was therefore understood, and that Mr. Dawes relying on the verbal description of what he saw on Nov. 29, was not clearly understood in consequence of omitting his sketch.

and, taken together, they pretty distinctly show the extent of my discovery on that night. This was,—

“A dull, slightly reflective, zone, appearing as if illuminated by twilight, or like a very dull, unreflective portion of the moon, when the sun shines upon it *very* obliquely; extending towards the ball from a dark shaded boundary at the inner edge of the bright ring, to a distance about equal to the inner portion (or rather more than two-thirds of the breadth) of the outer ring; and seen projected upon the ball as a narrow dark line of elliptic form. This zone I considered to be a continuation of the breadth of the inner ring; the dark boundary between them not suggesting the idea of a complete separation.

“As no important addition was made to the discoveries of Nov. 29, up to the time of sending my paper to the Society, the woodcut appended to that paper may be taken as representing my original diagram in all essential points, when *corrected* by the following remarks upon it.

“The principal points it was intended to illustrate were, the position and comparative visibility of the division in the outer ring; and the situation and breadth of the obscure zone, with its narrow projection where it crosses the ball. The former is well shown; but the obscure zone is made *much too broad*. In my description it is stated to be about the breadth of the inner portion of the outer ring, and to appear like a very faint continuation of the breadth of the inner ring, occupying about *four-tenths* of the interval between the interior boundary of the bright part of the ring and the edge of the ball. In the engraving its breadth is *two-thirds* of that interval; and, consequently, the projection of the part which crosses the ball is also much too broad.

“The shadow of the ball upon the ring should be rather broader towards the bottom, and its outer edge *slightly convex* towards the ball. This convexity I have always observed of late, and depicted in my diagrams; though I am unable to account for the appearance, as the extreme thinness of the ring does not seem to allow of sufficient convexity of its surface to produce the effect. Perhaps it is only the effect of *contrast* with the much greater curvature of the edge of the ball.

“The belts on the ball are nearly in their right situation, but are, of course, far too strong and distinct. They have lately been only slightly distinguished from the general duskiness of the planet's southern hemisphere; but a wood-engraving cannot be expected accurately to represent shadings so delicate; and, consequently, the gradual shading off of the inner portion of the bright ring is not attempted.”

Further Observations of the Ring of Saturn. By the Rev. W. R. Dawes.

“I have frequently received the impression of the newly-discovered obscure ring being divided into two, or else composed of two

zones of different reflective power; the inner one possessing the least, and being also much narrower than the other. That nearest the bright ring has been repeatedly seen *in twilight*, extending to about *one-third* of the interval between the bright ring and the ball; its outer and inner edges presenting an elliptic curve pretty well defined for so faint an object. As the twilight faded, another, interior, and narrower zone has appeared, having also a well-defined elliptic inner edge; an extremely narrow dark boundary, or division, lying between the two. When the obscure ring, taken as a whole, appears broadest, it is not of *uniform* brightness, the outer portion being the brighter: and in ordinary states of the air, this outer portion alone is visible; while, during occasional fits of better vision, and on very fine nights, the inner portion also is seen.

“Supposing that, according to Struve’s measures, the interval between the ball and the interior bright ring is $4''.34$, I should estimate the breadth of the different portions nearly as follows:—

Dark boundary, or interval, between bright ring and exterior obscure ring..	$0''.3$
Breadth of the exterior obscure ring	$1''.1$
Breadth of interior obscure ring and dark boundary between the two.....	$0''.6$
	$2''.0$
Interval between inner edge and the ball	$2''.34$

“On the whole, the idea of two rings appears more probable than that of two zones of different reflective power on the same ring; since, in the latter case, the inner edge of the exterior one would be unlikely to present a well-defined elliptic outline.

“Micrometrical measurements of the breadth of the obscure ring have been repeatedly attempted; but the difficulty of the observation is extreme. The results are the following, reduced to the mean distance of *Saturn*. They include the whole space from the inner edge of the bright ring to the inner edge of the obscure ring when most perfectly seen. Power employed on each occasion 375.

1850. Dec. 20	$1''.807$ by 6 observations.	Weight 6
22	$1''.967$ — 6 —	10
1851. Jan. 23	$1''.958$ — 10 —	32
Mean, allowing weights =	$1''.941$ — 22 —	48

“I have always observed, that the upper and more distant portion of the obscure ring is more plainly seen than the corresponding portion on the side nearest to the earth; and also that the projection of it at its inner axis is considerably narrower than accords with its breadth at the major axis.”

Extract of a Letter from Father Secchi, Director of the Observatory of the Collegio Romano, to the Astronomer Royal.

“January 15, 1851.

“We have calculated the elements of *Egeria*, by Professor

Challis's method, using the Naples observations of November 8th, 15th, and 22d, made by M. de Gasparis, the results which follow can only be regarded as a rough approximation.

Epoch, November 15^o, 1850, Greenwich Mean Time.

Mean Anomaly	293 38 14 ^{''} 25	} Mean Eq ^x . January 1850.
Long. of Perihelion	114 35 11 ^{''} 5	
Ascending Node.....	43 46 33 ^{''} 86	
Inclination	15 35 53 ^{''} 80	
Mean Diurnal Motion	872 ^{''} 401169	
Semi-axis Major.....	2 ^{''} 547967	
Excentricity	0 ^{''} 09667279	
Sidereal Period	4 ^{''} 78 ^{''} 0671539	

"We have applied the corrections for aberration and parallax, nutation and precession. The middle observation is exactly represented; the extremes are also exactly represented in right ascension, but in declination there is a difference for the first of +3^{''}5, and in the last of -3^{''}1, which seems to indicate a correction to be made in the inclination and node. As soon as we have new observations these elements will be corrected.

Saturn's Ring.—"I observed on the evening of the 23d of November, 1850, that the shadow of the ball on the ring was slightly curved, its convexity being opposed to the ball. The inner edge of the planet seemed to me also exceedingly ill defined, and I supposed both phenomena to be due to a convexity in the surface of the ring. I wrote about this subject to Mr. Lassell, who answered that he too had seen the shadow so curved, and also a kind of crape veil, or shade in the inside of the inner ring, which seems to extend in a dark thin line before the planet, where it is crossed by the ring. This is exactly what I, too, have seen since the indication of Mr. Lassell, who with his powerful telescope could see clearly what we could only see in a confused manner.* There is, therefore, something new in this marvellous planet, but I need say no more since you will have better information from Mr. Lassell himself."

At the close of the meeting, Sir John Lubbock favoured the Society with some remarks on the properties and uses of the *Gnomonic Projection of the Sphere*.

The especial view of this lecture was to point out the facility with which, by means of maps drawn upon this projection, the solution of problems in what is called "the use of the globes" may be accomplished.†

* The observations of MM. Dawes and Lassell on the novel appendage to *Saturn*, were made at Watlingbury with Mr. Dawes' refractor of 6½ inches aperture, the workmanship of Merz, of Munich.

† A demonstration of the rules for performing these operations will be found

As the circles of the sphere in this projection are laid down according to their perspective representations, as viewed from the eye placed at the centre of the sphere, it is necessary to bear in mind the rules by which accurate projections upon a given plane of any original lines are procured.

Having recapitulated these rules, the author pointed out how any great circle can be graduated, and how a great circle can be drawn making any given angle with another.

Problems connected with the rising and setting of stars and the like, depend upon finding the horizon. This is easily accomplished by ascertaining, from the sidereal time and the latitude of the place, the cardinal points; and a straight line joining any two of them represents the horizon. The method of laying down the vertical circles was explained.

The author also remarked that, by means of the rules of perspective, not only the projection of any given circle upon any given plane may be drawn, but conversely, the original circle of which any given conic section may be the projection, can be determined.

It was shown how, by means of this principle, a general method was furnished of constructing by points any given conic section, and of drawing tangents to it from points either situated or not upon the curve.

VICTORIA.

LIVERPOOL.

Equatoreal.

(Mr. Hartnup.)

1851.	Green. M.T.			R.A.			Log $\frac{p}{P}$	N.P.D.			Log $\frac{q}{P}$	Star of Comparison.
	h	m	s	h	m	s		°	'	"		
Jan. 12	6	51	20.7	0	36	0.83	+8.186	83	3	43.6	-9.8614	δ Piscium
	7	21	18.2		2.75		.302			43.0	.8638	—
22	8	24	21.3	51	10.99		.501	82	2	10.4	.8695	ϵ Piscium
	8	54	18.7		12.89		.540			6.1	.8748	—
23	7	44	30.9	0	52	40.80	.434	81	55	52.6	.8630	δ Piscium
	8	4	29.4		42.12		+8.472			46.0	-9.8661	—

Where P is the equatoreal horizontal parallax, p and q the corrections for parallax in time and arc respectively.

The assumed *mean* places of the stars of comparison for 1851.0, are derived from the Greenwich 12-year Catalogue.

	R.A.			N.P.D.		
	h	m	s	°	'	"
δ Piscium	0	40	57.29	83	13	36.56
" —	0	55	12.86	82	54	47.81

in Sir John Lubbock's tract *On the Gnomonic Projection of the Sphere*: small maps of the earth and of the heavens on the gnomonic projection may be procured at No. 6 Charing Cross for 1d. each. Sir John states that he can solve problems on these maps as exactly as by a 12-inch globe.

DURHAM. Fraunhofer Equatoreal. (Mr. R. C. Carrington.)

1850.	Green. M.T.			App. R.A.			App. N.P.D.			No. of Comps.		
	h	m	s	h	m	s	°	'	"	R.A.	N.P.D.	Set.
Nov. 2	10	18	52.4	23	24	17.99	83	57	37.2	24	8	20
4	10	47	37.5	24	55	47	84	10	8.7	8	8	21
5	8	2	42.5	25	14	09	15	19	8	24	8	22
8	9	36	40.8	26	29	43	31	45	3	11	4	23
12	11	11	37.9	28	32	64	50	0	1	24	8	24
	12	0	12.4		33	67		4	7	18	6	25
14	7	17	47.7	29	36	96	84	57	0.1	14	8	26
16	8	23	6.2	30	53	90	85	3	45.8	23	8	27
21	8	32	27.2	34	28	87	16	21	9	24	8	28
27	10	16	21.2	39	33	50	24	9	3	12	6	29
28	9	59	6.9	23	40	26.84	85	24	41.5	23	8	30

Assumed Apparent Places of Stars of Comparison.

Name.		App. R.A.			App. N.P.D.			Set.
		h	m	s	°	'	"	
Weisse, xxiii. No. 594		23	28	39.69	83	57	44.4	20
— — 458		22	46	73	84	23	42.6	21
B.A.C. 8177, Greenwich 12-year Cat.		20	24	07	26	20	6	22
— — — — —		20	24	04	26	20	7	23
Weisse, xxiii. No. 602		29	12	37	54	26	0	24
— — 534		26	16	05	51	26	5	25
— — 602		29	12	35	84	54	26.1	26
♈ Piscium. From the Naut. Alm.		32	16	58	85	10	52.7	27
— — — — —		32	16	53	10	52	9	28
Weisse, xxiii. No. 803		39	24	67	34	40	9	29
— — — — —		23	39	24.66	85	34	41.0	30

The observations have been corrected for refraction, and for parallax by M. Yvon Villarceau's ephemeris.

Nov. 2. Wind so loud that no observations could be taken till the planet had passed the meridian.

Nov. 4. Wind extremely boisterous. The hearing tube used throughout, but the beats frequently drowned by the roaring.

Nov. 5. Windy. The differences turned out better than expected.

Nov. 8. Not a favourable observation: troubled by wind and haze, principally by the latter.

Nov. 12. The sky recently cleared.

Nov. 14. The planet dim from moonlight entering the field.

Nov. 27. Planet and star in a difficult position. Right ascension and north polar distance measures taken separately. Some suspicion about the setting of the wire-frame on this occasion.

Nov. 28. Planet better seen than on the 27th. Observation was discontinued after this date, as the measures were found to be losing the requisite precision.

"Since the publication of M. Villarceau's ephemeris, I have applied the corrections for parallax to my former observations, and I subjoin a list of the resulting differences between the observed and computed places. I have altered the assumed place of one star only, that of set 10, taking it in preference from the Greenwich 12-year Catalogue. An error of one revolution of the micrometer (20".0) has also been corrected. One revolution is assumed to be = 20".000 — 0".0020 (T = 45° Fahr.).

Excesses of the Ephemeris over Observation.

Set.	R.A.	N.P.D.	Set.	R.A.	N.P.D.	Set.	R.A.	N.P.D.
1	+0°01	-0°1	11	+0°12	-3°5	21	-0°33	+2°6
2	+0°19	+1°0	12	0°00	+0°4	22	-0°27	+2°0
3	-0°39	+1°2	13	-0°07	+1°5	23	-0°64	+2°8
4	-0°30	+2°0	14	+0°36	+2°9	24	-0°54	+4°7
5	+0°13	+3°3	15	-0°35	+1°1	25	-0°44	+8°2
6	+0°09	+0°8	16	-0°64	+2°5	26	-0°63	+1°7
7	+0°42	-1°3	17	+0°15	+0°6	27	-0°12	+3°9
8	+0°32	-2°8	18	+0°31	+0°3	28	-0°58	+2°1
9	+0°36	-0°9	19	+0°50	-0°5	29	-1°17	+5°2
10	+0°36	-3°2	20	-0°31	+3°2	30	-0°81	+5°6

"Assuming that these excesses may be represented generally by the formula,

$$E = A + B \cdot t + C \cdot t^2,$$

the values of A, B, and C, have been computed by the formulæ given by the principle of minimum squares, and the results are,

$$\text{Excess in R.A.} = +0^{\circ}688 + 0^{\circ}2102 \cdot t - 0^{\circ}00598 \cdot t^2$$

$$\text{N.P.D.} = +0^{\circ}020 - 0^{\circ}0336 \cdot t + 0^{\circ}00166 \cdot t^2$$

t being reckoned in mean days from September 20°0.

"For every ten days these expressions give,

Calculated—Observed.			Calculated—Observed.		
	R.A.	N.P.D.		R.A.	N.P.D.
Sept. 20	+0°046	+0°02	Oct. 30	-0°031	+1°33
30	+0°146	-0°15	Nov. 9	-0°250	+2°49
Oct. 10	+0°167	+0°01	19	-0°549	+3°98
20	+0°107	+0°50	29	-0°927	+5°80

which must be considered the results of the Durham observations for this opposition. We depend entirely on others for the re-observation of the stars of comparison, by far the greater number being too small for the Durham transit circle."

MARKREE.

Mer. Circle.

(E. J. Cooper, Esq.,
and A. Graham.)

1850.	Green. M.T.	R.A.			Decl.	No. Wires.	Obsd—Calc ^d	
		h	m	s			R.A.	Decl.
Sept.	17°520081	23	41	24°62	+13 31 11°0	5	-0°15	+1°9
	21°506906	38	9	39	12 52 21°3	3	-0°48	+2°2
	23°500352	36	34	70	12 31 47°8	5	-0°46	-1°7
	24°497087	35	48	41	12 21 20°1	5	-0°32	-1°2
Oct.	1°474513	30	48	60	11 5 14°7	3	-0°56	-0°9
Dec.	7°304379	49	17	79	4 39 2°7	5	+0°29	+6°0
	13°292639	23	56	0°01	4 49 39°6	5	+0°41	+7°5
	21°277517	0	5	42°51	+5 12 32°0	5	+0°51	+5°9

"Corrected for parallax by Villarceau's ephemeris, *Comptes Rendus*, vol. xxxi. p. 681: the two last columns give the comparison between the observed places and those interpolated from Villarceau's ephemeris."

Sept. 17. Good observation.

Dec. 7. Good observation.

Dec. 13. Very faint.

The following *apparent* places of stars which were either observed by mistake for *Victoria* and *Egeria*, or observed at the same time, may be useful to extra-meridian observers:—

1850.		R.A.			Decl.		
		h	m	s	°	'	"
Sept. 30		23	31	19.80	+ 11	22	12.9
Oct. 4		23	28	58.12	10	41	49.6
9		23	25	28.47	9	32	48.1
Dec. 21	9 mag.	0	4	42.09	5	11	59.3
—		1	33	0.59	11	0	13.3
1851.							
Jan. 8		1	39	58.47	+ 13	8	20.2

Elements.

By Dr. B. A. Gould of Cambridge, U.S., from two Normal Places, and an Observation at Washington on December 20th.

Epoch, 1851, Jan. 0.0, Berlin Mean Time.

Mean Anomaly	65 47 23.0	
Ascending Node.....	235 29 49.8	Mean Equinox.
$\pi - \Omega$	66 25 22.2	
i	8 23 1.9	
ϕ	12 35 46.9	
μ	16' 34" 715	
Log a	0.3682053	
Log e	9.3386184	
Log μ	2.9976987	
Period	1302 days.88	Sidereal.

Ephemeris. By M. Yvon Villarceau.

For Paris Mean Noon.

1851.	h	R.A.			Decl.	Log Δ .	1851.	h	R.A.			Decl.	Log Δ .
		°	m	s					°	m	s		
Jan. 1	0	19	52.95		+ 5 56 28.0	0.31519	Jan. 16	0	41	31.01		+ 7 18 2.1	0.35904
2		21	15.94		+ 6 1 15.1	.31826	17		43	1.15		24 7.0	.36179
3		22	39.48		6 8.5	.32131	18		44	31.69		30 15.9	.36452
4		24	3.57		11 7.9	.32434	19		46	2.62		36 28.6	.36723
5		25	28.20		16 13.4	.32735	20		47	33.93		42 45.0	.36992
6		26	53.35		21 24.6	.33034	21		49	5.62		49 5.2	.37258
7		28	19.01		26 41.5	.33330	22		50	37.68	+ 7 55 28.7		.37523
8		29	45.17		32 3.9	.33625	23		52	10.11	+ 8 1 55.6		.37785
9		31	11.82		37 31.7	.33917	24		53	42.89	8 25.8		.38046
10		32	38.94		43 4.6	.34208	25		55	16.04	14 59.0		.38304
11		34	6.51		48 42.6	.34496	26		56	49.53	21 35.3		.38560
12		35	34.55	+ 6	54 25.4	.34782	27		58	23.37	28 14.5		.38815
13		37	3.02	+ 7	0 12.9	.35065	28	0	59	57.56	34 56.6		.39067
14		38	31.93		6 4.9	.35347	29	1	1	32.07	41 41.3		.39317
15	0	40	1.26	+ 7	12 1.4	0.35626	30	1	3	6.92	+ 8 48 28.6		0.39564

1851.	h	R.A.	Decl.	Log Δ.	1851.	h	R.A.	Decl.	Log Δ.
Jan. 31	1	4 42'09	+ 8 55 18'3	0'39810	Mar. 3	1	56 3'32	+ 12 37 13'9	0'46406
Feb. 1		6 17'58	+ 9 2 10'4	'40054	4		57 46'28	44 26'2	'46587
2		7 53'38	9 4'7	'40295	5	1	59 29'43	51 37'6	'46766
3		9 29'49	16 1'1	'40535	6	2	1 12'76	+ 12 58 48'2	'46943
4	11	5'90	22 59'6	'40772	7		2 56'27	+ 13 5 57'7	'47118
5	12	42'59	29 59'8	'41007	8		4 39'96	13 6'3	'47291
6	14	19'58	37 1'8	'41240	9		6 23'82	20 13'7	'47463
7	15	56'84	44 5'5	'41471	10		8 7'85	27 19'8	'47632
8	17	34'38	51 10'8	'41700	11		9 52'04	34 24'6	'47800
9	19	12'18	+ 9 58 17'4	'41927	12	11	36'39	41 28'1	'47965
10	20	50'25	+ 10 5 25'3	'42152	13	13	20'90	48 30'1	'48129
11	22	28'56	12 34'4	'42374	14	15	5'57	+ 13 55 30'5	'48290
12	24	7'13	19 44'5	'42595	15	16	50'39	+ 14 2 29'3	'48450
13	25	45'95	26 55'6	'42813	16	18	35'35	9 26'4	'48601
14	27	25'00	34 7'6	'43030	17	20	20'46	16 21'8	'4876
15	29	4'30	41 20'3	'43244	18	22	5'73	23 15'4	'48911
16	30	43'83	48 33'7	'43457	19	23	51'14	30 7'0	'4907
17	32	23'58	+ 10 55 47'6	'43667	20	25	36'70	36 56'8	'49222
18	34	3'57	+ 11 3 2'0	'43875	21	27	22'40	43 44'6	'4937
19	35	43'78	10 16'8	'44082	22	29	8'25	50 30'2	'49511
20	37	24'22	17 31'9	'44287	23	30	54'24	+ 14 57 13'7	'4966
21	39	4'88	24 47'2	'44489	24	32	40'37	+ 15 3 55'1	'49801
22	40	45'77	32 2'6	'44690	25	34	26'64	10 34'2	'4994
23	42	26'87	39 18'1	'44888	26	36	13'05	17 11'0	'5008
24	44	8'20	46 33'6	'45085	27	37	59'59	23 45'5	'5022
25	45	49'74	+ 11 53 48'9	'45279	28	39	46'28	30 17'5	'5036
26	47	31'49	+ 12 1 4'1	'45472	29	41	33'09	36 47'1	'5049
27	49	13'45	8 19'0	'45663	30	43	20'03	43 14'1	'5063
28	50	55'62	15 33'5	'45852	31	45	7'10	49 38'6	'5076
Mar. 1	52	37'99	22 47'5	'46038	April 1	2	46 54'29	+ 15 56 0'4	0'5000
2	1	54 20'55	+ 12 30 1'0	0'46223					

"This ephemeris is a continuation of that published by M. Villarceau in *Comptes Rendus*, vol. xxxi. pp. 681, 2, and is calculated from the elements p. 680."

FLORA.

DURHAM. Fraunhofer Equatoreal. (Mr. R. C. Carrington.

1850.	Greenwich M.T.	App. R.A.	App. N.P.D.	No. of Comps.		
	h m s	h m s	° ' "	R.A.	N.P.D.	S
Nov. 5	10 15 22'3	23 58 41'80	101 30 14'2	24	8	
	11 0 41'0	42'01	4'2	23	8	8
8	11 37 4'0	23 58 59'96	101 13 40'8	9	3	9
21	11 24 17'8	0 3 51'22	99 38 5'1	7	3	10

Assumed *Apparent* Places of Stars of Comparison.

Set.	Name.	R.A.	N.P.D.
		^h _m ^s	[°] _' ["]
7	B.A.C. 8361	23 56 51.85	101 20 23.7
8	Weisse, xxiii. 1232	23 59 54.37	101 32 0.3
9	B.A.C. 8361	23 56 51.83	101 20 24.0
10	Weisse, xxiii. 1249	0 0 40.66	99 39 15.6

Nov. 5, very windy.

Nov. 8, state of the atmosphere very unfavourable.³

Nov. 21, very hazy. The planet sunk down into a bank of fog.

MARKREE.

Mer. Circle.

(E. J. Cooper, Esq.,
and A. Graham.)

	Green. M.T.	R.A.	Decl.	No. Wires.	Obs ^d —Calc ^d
1850.	^d	^h _m ^s	[°] _' ["]		[°] _' ["]
Oct.	9.479411	0 9 25.36	—11 51 55.4	5	—2.94 —16.4

"Corrected for parallax and interpolated from the *Nautical Almanac*."

EGERIA.

MARKREE.

Mer. Circle.

(E. J. Cooper, Esq.,
and A. Graham.)

	Green. M.T.	R.A.	Decl.	No. Wires.	Obs ^d —Calc ^d
1851.	^d	^h _m ^s	[°] _' ["]		[°] _' ["]
Jan.	13.281945	1 42 46.91	+13 47 3.9	5	—1.05 —0.2

"Corrected for parallax and compared place computed from G. Rümker's Ephemeris, *Monthly Notices*, vol. xi. p. 34. *Egeria* very faint."

HAMBURG.

Equatoreal.

(M. C. Rümker.)

	Hamburg M.T.	R.A.	Decl.	Obs.
1850.	^h _m ^s	[°] _' ["]	[°] _' ["]	
Dec. 16	8 21 33.8	23 13 38.4	+10 30 30.1	28
17	5 45 8.6	23 13 14.0	10 35 35.6	7
26	6 52 39.5	23 27 27.6	11 31 38.8	15
31	7 5 40.9	23 49 49.5	12 5 46.5	28
1851.				
Jan. 22	8 4 30.8	27 17 3.1	14 58 6.1	13
28	7 11 54.8	28 39 19.6	15 49 10.9	4
31	7 55 37.6	29 24 55.2	16 16 3.2	5
Feb. 1	7 18 22.7	29 40 10.0	+16 24 37.2	31

Mean Places of the Compared Stars for Jan. 0, 1851, deduced from Observations with the Meridian Circle at Hamburg.

	R.A.	Obs.	Decl.	Obs.	R.A.	Obs.	Decl.	Obs.
^h _m ^s	^h _m ^s		[°] _' ["]		^h _m ^s		[°] _' ["]	
1	29 12 ^h 26	4	+ 11 22 40 ^h .1	4	1 46 17 ^h 54	2	+ 8 51 51 ^h .0	3
	29 45 ^h 32	4	11 18 59 ^h .9	4	46 31 ^h 40	3	8 48	
	30 14 ^h 36	1	12 5 9 ^h .2	1	46 57 ^h 06	2	8 27 27 ^h .6	2
	34 18 ^h 66	2	10 35 48 ^h .8	2	50 34 ^h 04	1	15 12 9 ^h .2	1
	35 13 ^h 11	2	12 9 9 ^h .3	1	52 27 ^h 04	1	8 39 43 ^h .1	1
	35 41 ^h 70	2	12 7 47 ^h .8	3	52 52 ^h 13	5	8 29 15 ^h .4	5
	40 41 ^h 92	3	9 28 12 ^h .6	3	53 3 ^h 66	1	15 50 34 ^h .1	1
	42 25 ^h 61	4	9 4 9 ^h .1	4	1 54 42 ^h 67	1	8 21 38 ^h .6	1
1	44 45 ^h 84	2	+ 8 50 58 ^h .3	2	2 1 12 ^h 38	1	+ 16 31 23 ^h .2	1

Ephemeris. By M. G. Rümker.

For Greenwich Mean Noon.

1851.						1851.						
R.A.						R.A.						
Decl.						Decl.						
Log Δ.						Log Δ.						
1851.	h	m	s	°	'	1851.	h	m	s	°	'	
Jan. 12	1	41	23.6	+	13 34.0	0.33277	Feb. 6	2	3 58.7	+	17 7.8	0.39076
13	42	3.5			42.0	.33525	7	5 6.9			16.8	.39287
14	42	44.7			50.0	.33773	8	6 16.1			25.9	.39496
15	43	27.1	+	13 58.0	.34020	9	7 26.2			35.0		.39704
16	44	10.8	+	14 6.1	.34265	10	8 37.2			44.2		.39910
17	44	55.8			14.3	.34507	11	9 49.2	+	17 53.3		.40114
18	45	42.1			22.6	.34749	12	11 2.1	+	18 2.5		.40317
19	46	29.6			30.9	.34990	13	12 15.8			11.7	.40518
20	47	18.3			39.2	.35230	14	13 30.4			20.9	.40716
21	48	8.2			47.6	.35468	15	14 45.9			30.1	.40913
22	48	59.8	+	14 56.0	.35705	16	16 2.2			39.3		.41108
23	49	51.5	+	15 4.5	.35941	17	17 19.2			48.6		.41302
24	50	45.0			13.0	.36175	18	18 37.4	+	18 57.8		.41494
25	51	39.6			21.6	.36408	19	19 56.3	+	19 7.1		.41684
26	52	35.3			30.3	.36639	20	21 16.0			16.3	.41872
27	53	32.0			38.9	.36868	21	22 36.5			25.6	.42058
28	54	30.0			47.6	.37096	22	23 57.8			34.9	.42243
29	55	29.0	+	15 56.4	.37323	23	25 19.9			44.2		.42426
30	56	29.1	+	16 5.2	.37548	24	26 42.8	+	19 53.5			.42607
31	57	30.2			14.0	.37771	25	28 6.5	+	20 2.8		.42786
Feb. 1	58	32.4			22.9	.37993	26	29 30.0			12.1	.42963
2	1 59	35.7			31.8	.38213	27	30 56.2			21.3	.43139
3	2 0	39.9			40.7	.38431	28	32 22.3			30.6	.43313
4	1 45.2				49.7	.38647	Mar. 1	2 33 49.0	+	20 39.9		0.43485
5	2 2 51.5	+	16 58.7	0.38862								

From the Second Elements, see vol. xi. p. 32.

METIS.

MARKREE.

Mer. Circle.

(E. J. Cooper, Esq.,
and A. Graham.)

Greenwich M. T.	R.A.			Decl.	No. Wires.	Obs ^d —Calc ^d	
1850. d	h	m	s			R.A.	Decl.
Dec. 11.706193	9	58	22.72	+18 55 15.0	5	-0.03	0.0
1851. Jan. 8.640815	10	1	15.34	20 43 24.1	5	+0.06	0.0
17.613244	9	56	31.85	21 42 44.6	1	+0.18	+2.4
24.590220	9	51	10.86	+22 32 10.6	4	+0.06	+3.1

“Corrected for parallax and compared places computed from Graham's *Elements, Monthly Notices*, vol. xi. p. 36.”Jan. 8. *Metis* much brighter than was expected.

17. Clouds.

LIVERPOOL. 20-foot Equatoreal. (Mr. Hartnup.)

1851.	Green. M.T.			R.A.			N.P.D.			Comp ^d —Obs ^d	
	h	m	s	h	m	s	°	'	"	R.A.	N.P.D.
Feb. 1	9	13	52.1	9	43	53.65	66	33	36.5	-3.43	+5.0
	9	28	49.5			53.02			33.1	-3.42	+4.2
	9	43	46.8			52.45			28.7	-3.47	+4.5

"The parallax and computed places were deduced from the ephemeris published by the superintendent of the *Nautical Almanac*.

"The star of comparison for all the observations was *Leonis*. The following is the assumed *mean* place for 1851.0 derived from the Greenwich Observations for 1848.

Leonis	R.A.			N.P.D.		
	h	m	s	h	m	s
	9	37	23.02	65	32	32.68

SATELLITE OF NEPTUNE.

Observations.

STARFIELD.		20-foot Equatoreal.				(Mr. Lassell.)	
1850.		G.M.T.		Position.	Obs.	G.M.T.	
		h	m			h	m
Aug. 15		11	46	40 41	5	12	24
	20	12	5	23 35	2		
Sept. 8		10	54	47 55	5	11	17
	10	10	15	212 33	2		
	11	9	44	222 3	4	9	44
	13	11	9	35 34	3		
	17	11	20	230 0	estim.		
	28	10	40	216 29	4	11	3
Oct. 1		9	36	40 3	2	9	12
	5	9	34	230 39	3	9	9
Nov. 2		9	2	214 52	3	8	43
	8	8	35	215 10	4	8	10

Remarks.

"(a.) Circumstances very favourable. Satellite bright and position measures taken easily. Those of distance good, but taken with less facility. Power 614.

"(b.) Circumstances very unfavourable. Moon full and very near. Night stormy; and these measures were obtained during a brief interval of clear sky. Power 614. Obligated to close the dome hastily by a heavy shower, which, however, gratified me with a sight of a very beautiful and perfect lunar rainbow, in which the three colours (red, orange, and blue) were very obtrusive.

"(c.) Sky very hazy. Wind easterly, and definition bad. Power 614.

"(d.) Atmosphere extremely unfavourable, and the satellite so faint, that no further satisfactory measures could be got.

"(e.) Atmosphere bad, and measures taken with great difficulty. Power 366.

"(f.) Sky too unfavourable to allow any measures of distance to be taken.

"(g.) The almost full moon in the immediate neighbourhood of the planet,

and the telescope was pointed at the object chiefly out of curiosity to ascertain whether, under the circumstances, the satellite could be seen.

“(h.) Satellite very bright and positions easily taken, but the sky became unfavourable while taking the measures of distance. Power 614.

“(i.) Bright flashing aurora, and a confused atmosphere. Measures carefully taken, but with a difficulty that might well be termed torture.

“(k.) Satellite extremely faint. Finding it very difficult to get measures with power 614, I tried 366, but did not see the satellite so well with this power: and, therefore, observed with the former.

“(l.) Sky bright occasionally, but frequently overcast. Wind strong from S.W., and blowing right into the opening of the dome, somewhat shook the telescope.

“(m.) Sky so hazy that, though the observations seem coincident, it was perfect torture to get them. Power 614.”

*Observed Differences of Japetus and the Centre of Saturn in
R.A. and N.P.D. By Mr. Lassell.*

1850.		G.M.T.							
		h	m						
Sept.	11	10	0	Japetus follows	467 ³	Japetus North	25 ⁸		
	12	11	20	—	500 ⁴				
Oct.	5	11	0	—	178 ⁰	—	—	161 ²	
	9	13	54	— precedes	9 ⁰	—	—	129 ⁷	
	10	11	30	—	44 ⁵	—	—	120 ⁴	
	11	9	27	—	91 ²	—	—	109 ⁶	
	21	8	30	—	453 ⁷	—	South	19 ⁴	
	23	11	30	—	498 ²	—	—	38 ⁷	
Nov.	2	11	0	—	499 ⁹	—	—	146 ²	
	8	9	30	—	356 ²	—	—	154 ⁸	
	14	8	40	—	112 ⁴	—	—	137 ⁶	
	16	10	10	—	22 ⁵	—	—	120 ⁸	
	21	9	20	— follows	201 ⁰	—	—	76 ⁰	
Dec.	11	9	30	—	516 ⁰	—	North	136 ⁵	
	12	6	30	—	496 ⁰	—	—	140 ⁷	
	19	6	50	—	296 ²	—	—	142 ⁸	
	21	10	2	—	214 ⁰	—	—	145 ⁰	
	24	5	10	—	102 ²	—	—	136 ⁵	

Similar Observations of Hyperion.

1850.		h m							
		h	m						
Sept.	17	12	36	Hyperion follows	200 ⁷	Hyperion North	28 ⁰		
Oct.	5	11	30	—	270 ⁰	—	South	12 ⁰	
	9	13	39	—	154 ⁶	—	North	33 ⁶	
	11	10	25	—	22 ⁰	—	—	40 ⁴	
Nov.	8	10	38	— precedes	152 ⁵	—	South	23 ⁰	
	21	9	20	— follows	119 ⁵	—	North	32 ⁰	

FAYE'S COMET.

CAMBRIDGE, U.S.

Equatoreal. (Professor W. C. Bond.)

Cambridge M.T.				R.A.		Obs.	N.P.D.		Obs.
1851.	h	m	s	m	s		'	"	
Jan. 1	8	3	53	a + 0	12.7	(6)	a + 1	16.2	(6)
	4	7	9 54	22 39	14.12	(4)	94 15	1.7	(4) Weisse, 870

Approximate value of a , a star of the 8th magnitude.

R.A. $22^h 32^m 43^s$

N.P.D. $94^\circ 37'$

"The comet is a very faint object in our large equatoreal; when best seen it appeared slightly elongated in the direction of the sun."

BOND'S COMET.

The stars used at Durham (see vol. xi. No. 1) corrected.

	Mean R.A. (1850.0).			Mean N.P.D.			No. of Obs.	
	h	m	s	°	'	"		
Lalande, 14384	7	17	9.02	43	10	52.0	3	Set (1)
Anonymous	7	43	15.56	50	8	9.4	2	(2)
Lalande, 15636	7	53	33.16	52	26	57.8	2	(3)
App. Place of (1) on Sept 13	App. R.A.			App. N.P.D.				
	h	m	s	°	'	"		
(1)	7	17	9.96	43	11	6.9		
(2)		16		50	8	22.4		
(3)		17		52	27	10.2		

"These are meridian observations taken with the small transit circle of the Durham Observatory. Star (2) was almost too faint for the aperture of the telescope. There was an error of 1^m in its R.A. as previously assumed."

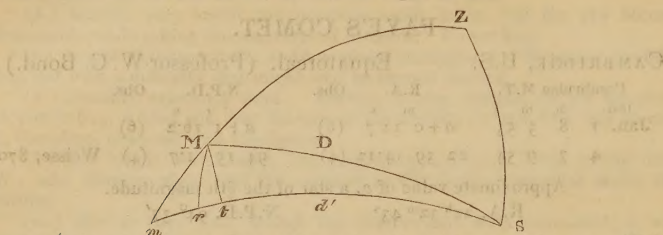
On a Method of Computing the small Corrections for clearing the Lunar Distance. By John Riddle, F.R.A.S.

"In the demonstration of this problem I have preferred to proceed by spherical trigonometry, as it enables us to see more plainly the several parts of the small differences sought for.

"As in correcting the distance separately for errors in places of the moon and of the sun or star, the formulæ for the corrections due to each object must be of precisely the same form and character, we shall suppose the effect of the parallax (when any exists) and of the refraction of the sun or star to be already allowed for (the formulæ for this purpose being given incidentally); and that it only remains to correct the observed distance for the parallax and refraction of the moon.

"Let then S be the true place of the sun or star, and M the true place of the moon, m being her apparent place, mM the correction of her altitude $= p$; then Sm is the distance between the

true place of the sun or star and the apparent place of the moon, let $= d'$, and SM the true distance sought $= D$.



"If Mt be drawn perpendicular to mS , and Sr be equal to SM , then,

$$SM = Sm - mr = Sm - (mt - tr) = d' - (c_2 - c_3),$$

and thus $mt - tr$ is the correction required on account of the moon, which is to be subtracted from Sm or d' .

"Now $mt = mM \cos \angle m$, or representing mM by p and expressing the value of $\cos \angle m$ in terms of the altitudes and distance d'

$$c_2 = p \sin a' \sec b \operatorname{cosec} d' - p \tan b \cot d' \quad (1)$$

Where a' and b are respectively the true altitudes of the sun or star, and the apparent altitude of the moon.

"Similarly the corresponding term of the correction of the distance, on account of the sun or star, will be

$$c_1 = p' \sin b \sec a \operatorname{cosec} d - p' \tan a \cot d \quad (2)$$

a , b , and d , being the apparent altitudes and apparent distance, and p' the correction of the sun's or star's altitude: $d + c_1 = d'$.

"The quantities c_1 and c_2 are very readily found by using p and p' in seconds; logarithms of only four places, exclusive of the characteristic, are wanted.

"The correction c_3 is in all cases sufficient on account of the sun or star, the terms corresponding to rt or c_3 being inappreciable; but the neglect of this quantity with respect to the moon, may produce an error of several seconds in the distance.

Since $SM = Sr$; $\cos SM = \cos Sr = \cos (St + tr)$;

and $\cos SM = \cos St \cos tM$;

$\therefore \cos St \cos tM = \cos St \cos tr - \sin St \sin tr$.

Substituting $1 - 2 \sin^2 \frac{tM}{2}$, for $\cos tM$, and unity for the $\cos$ of the very small quantity tr , and reducing,

$\sin tr = 2 \cot St \sin^2 \frac{tM}{2}$

Now St is the distance corrected on account of the object at S , and once also on account of the moon; we denote it therefore by d'' , and then if tr and tM be supposed to be expressed in minutes and the equation be divided by $\sin 1'$, we have,

$$\begin{aligned} \text{In minutes } t \text{ or } c_3 &= \frac{1}{2} \cot d'' (t M)^2 \sin 1' \\ \text{In seconds } c_3 &= 30 \sin 1' \cot d'' (t M)^2 \\ \text{or since } (t M)^2 &= (m M)^2 - (m t)^2 = (p^2 - c_2^2) \\ c_3 &= 30 \sin 1' \cot d'' (p + c_2) (p - c_2), \end{aligned}$$

in which formula p and c_2 are still expressed in minutes.

"Now it so happens that $30 \sin 1' = .00873$, very nearly, and that this again differs from $\frac{1}{100} - \frac{1}{8} \frac{1}{100}$, by the small fraction $\frac{1}{50000}$ only; and when it is considered that the minutes in p and c_2 cannot exceed two figures each, the facility with which the value of the factors $30 \sin 1' (p + c_2) (p - c_2)$ can be computed, may be readily imagined. If we call this last quantity q ;

$$c_3 = q \cot d'',$$

and the entire correction on the moon's account is,

$$c_2 - c_3 = \{p \cdot \sin a' \sec b \operatorname{cosec} d' - p \tan b \cot d'\} - q \cot d'',$$

which is to be subtracted from d' to give D .

Example.

$$\begin{aligned} a &= \odot \text{'s App. Alt. } 24^\circ 40' 0'' \\ \text{Correction } &1' 56'' = 116'' = p' \\ a' &= \odot \text{'s True Alt. } 24^\circ 38' 4'' \\ b &= \text{J's App. Alt. } 16^\circ 53' 0'' \\ \text{Correction } &49' 28'' = 2968'' = p \\ d &= \text{App. Dist. } 111^\circ 27' 1'' \\ c_1 & \quad \quad \quad c_2 \\ \log p' &= 2.0645 \quad \log p = -2.0645 \quad \log p = 3.4725 \quad \log p = -3.4725 \\ l \sin b &9.4630 \quad l \sin a' &9.6199 \\ l \sec a &0.0416 \quad l \tan &9.6620 \quad l \sec b &0.0191 \quad l \tan &9.4822 \\ l \operatorname{cosec} d &0.0312 \quad l \cotan &-9.5943 \quad l \operatorname{cosec} d' &0.0312 \quad l \cotan &-9.5946 \\ &1.6003 \quad + 1.3208 \quad &3.1427 \quad + 2.5493 \\ \text{Nat. Num.} &= +39.8 \quad \text{Nat. Num.} = 1389 \\ &+ 20.9 \quad &+ 354.2 \\ 60.7 &= c_1 = 1' 0''.7 \quad 29' 3''.2 = 1743.2 = c_2 \end{aligned}$$

$$\begin{aligned} d &= 111^\circ 27' 1'' & p &= 49' \\ + c_1 &+ 1' 0''.7 & c_2 &= 29' \\ d' &= 111^\circ 28' 1.7'' & \text{Sum} &78 \\ - c_2 &- 29' 3.2'' & \text{Diff.} &20 \\ d'' &= 110^\circ 58' 58.5'' & .01 \times \text{Prod.} &= 15''.6 \\ + c_3 &- 5.3'' & - \frac{1}{8} &= -1.9'' \\ D &= 110^\circ 58' 53.2'' & \text{True Distance.} &13.7 \quad \log = 0.137 \\ & & l \cot d'' &-9.583 \\ & & \log c_3 &= 9.720, c_3 = -5''.3 \end{aligned}$$

"The result of a very careful computation by the direct trigonometrical process, using Taylor's logarithms to seven places, is $110^{\circ} 58' 53''$."

Examples.

App. Alt. Sun or Star.	Corr. Sun or Star.	App. Alt. of Moon.	Corr. of Moon's Alt.	App. Dist.	True Dist. by Method above.	True Dist. by Spherics.
27 43	1 51	48 22	38 0	81 23 38	81 4 39.9	81 4 39.8
7 48	6 30	35 45	42 50	95 49 12	95 42 50.4	95 42 50.4
31 38	1 24	68 50	20 24	37 23 23	37 44 55.3	37 44 55
37 40	1 14	6 25	46 56	50 27 36	49 54 7.2	49 54 7.6

"On the foregoing table I would observe that the true distances in the last column are worked with great care by Taylor's logarithms to seven places, and that tenths of seconds are accounted for. In practice, this, of course, is never done; but the result shows that the closer the computation by the direct process, the better appears the agreement with the simple method here proposed.

"In conclusion, the expressions for c_1 and c_2 may be at once derived by differentiation, and, as far as they are concerned, the method is not new, having been employed *with the aid of special tables* in various ways and under various modifications, and in Lyons' method the very formulæ are used.

"But I am not aware of anything analogous to the method of finding the correction c_3 , on which the perfection of the process depends. This quantity c_3 will also be found to coincide with the result of a second differentiation, corresponding to the term of the second order in Taylor's Theorem.

"Allow me to notice an error in connexion with this subject in Baron Zach's paper in vol. v. of our *Memoirs*.

"The first example in the table of results I have given, is also the first worked in that paper, in which it is stated that the result exactly agrees with the trigonometrical process. This is not the case, they differ nearly seven seconds; and on applying the necessary corrections to the data, and re-working as the author recommends, the result agrees within a few tenths of a second with that which I have given."

Some astronomical and surveying instruments belonging to the late Capt. Copeland, R.N. and others, have been forwarded to the Society to be disposed of at very reasonable prices.